Remarks

The Applicants have amended Claims 29 and 40 to recite that the ultra-fine fibers are uniformly entangled with each other in the thickness direction. Support may be found in the Applicants' specification in a number of locations such as on page 21, line 27. Claim 40 has further been amended to include the tensile strength amount currently recited in Claim 29. Thus, Claim 40 now also recites a tensile strength of 70 N/cm or more.

Claim 43 has been amended to recite that at least one surface of the leather sheet is raised by sand paper or brush. Support may be found in the Applicants' specification on page 5, paragraph [0088], for example.

Claim 39 has been cancelled.

Entry of the above amendments and cancellation into the official file is respectfully requested inasmuch as the above changes now place the application into final condition for allowance.

Claim 39 stands rejected under 35 USC §102 as being anticipated by Kato. The Applicants respectfully submit that this rejection is now moot in view of the cancellation of Claim 39. Withdrawal of the rejection is respectfully requested.

Claims 29, 32-38, 40, 42-45 and 47-48 stand rejected under 35 USC §102 as being anticipated by or, alternatively, under 35 USC §103 as being obvious over Kato. The Applicants note with appreciation the Examiner's detailed comments hypothetically applying Kato against those claims. The Applicants nonetheless respectfully submit that Kato fails to disclose, teach or suggest the subject matter of those claims.

As noted above, independent Claims 29 and 40 have been amended to recite that the ultra-fine fibers are uniformly entangled with each other in the thickness direction. This is important since Kato not only fails to disclose such uniform entanglement, but actually leads those skilled in the art away from such uniform entanglement. The reasons for this are quite clear, namely Kato teaches that the ultra-fine fibers are nonuniformly entangled.

The Applicants invite the Examiner's attention to multiple locations in Kato for this clear disclosure. The first occurrence is in the Abstract wherein the fiber bundles are entangled with one another and in which portions A and B are nonuniformly distributed in the direction of fabric thickness. Then, the "Summary of the Invention" section of Kato in column 2 repeats that

requirement wherein there is nonuniform distribution in the direction of fabric thickness as recited in lines 42-43.

Kato then teaches in column 3 at line 43-47 as follows:

> The objects of the present invention can be accomplished only when portions (A) and (B) are nonuniformly distributed in the direction of the thickness of the fabric. It is particularly preferred that portion (B) be nonuniformly distributed along the surface portion.

The above teachings by Kato are quite compelling. In that regard, it should be noted that not only does Kato teach that the portions should be nonuniformly distributed, but also note that the objects are achieved "only" when such nonuniform distribution occurs. The Applicants respectfully submit that this is a classic instance of the prior art teaching in the opposite direction of what is claimed, thereby leading those skilled in the art away from the claimed subject matter.

Finally, the requirement for nonuniform distribution is such that it is even included in Claim 1 of the Kato disclosure. There can be no doubt that it is important in Kato that the distribution is nonuniform in the direction of the thickness of the fabric. This is exactly the opposite of what the Applicants claim. Thus, the Applicants respectfully submit that Kato does not render Claims 29 and 40 anticipated because there is no disclosure of uniform distribution. The Applicants also respectfully submit that Kato cannot render Claims 29 and 40 obvious since Kato leads those skilled in the art away from the claimed subject matter. Withdrawal of the rejection is respectfully requested.

Claims 47-48 stand rejected under 35 USC §103 over the combination of Katayama with Kato. The Applicants respectfully submit that Katayama fails to cure the deficiencies set forth above with respect to Kato. Thus, Claims 47-48 cannot be obvious over the combination of Katayama with Kato. Withdrawal of the rejection is respectfully requested.

Claims 29, 32, 39, 40 and 44-45 stand rejected under 35 USC §103 as being obvious over Tadokoro. The Applicants respectfully submit that Tadokoro fails to disclose, teach or suggest the subject matter of Claims 29, 32, 40 and 44-45. The rejection is now moot as it applies to cancelled Claim 39.

The Applicants have amended Claim 40 as noted above to include the tensile strength of 70N/cm or more in the same manner of Claim 29. This is important with respect to Tadokoro. In that regard, Tadokoro fails to disclose the Applicants' claimed range of 70 N/cm or more.

However, tensile strengths are disclosed for the Examples and Comparative Examples in Tadokoro. This can be seen in Table 1 wherein Examples 1-3 have tensile strengths of 3.3, 3.5 and 3.1 kg/cm, respectively, and Comparative Examples 1-4 have tensile strengths of 2.0, 2.4, 3.5 and 3.2 kg/cm, respectively.

Tables 2, 3, 4 and 6 provide additional Examples and Comparative Examples disclosing various tensile strengths approximately in the same range as Table 1. Some entries are a bit lower and some are a bit higher. However, the Examples have tensile strengths ranging between 3.0 and 3.9 kg/cm.

It should be noted that the units of tensile strength "kg/cm^2" should be "kg/cm." Although Tadokoro uses the unit "kg/cm^2," that use is incorrect, "kg/cm" is correct. The Applicants enclose the corresponding International publication of Tadokoro (WO 96/20505). All data concerning tensile strength are described by unit of "kg/cm." The Applicants thus believe that "kg/cm^2" is an error in translation.

The tensile strength range of 3.0 and 3.9 kg/cm corresponds to a range of 29 to 38 N/cm. It can thus be quickly seen that those tensile strengths are far less than the Applicants' claimed range of 70 N/cm or more. In fact, most of the tensile strengths of the Tadokoro products are about half of the Applicants' minimum claimed tensile strength. The Applicants therefore respectfully submit that their claimed artificial leather sheets and nonwoven fabrics are completely different from Tadokoro and are not in any way suggested by Tadokoro. The Applicants' claimed materials have a substantially higher tensile strength placing them in a performance category that is completely unexpected based on the Tadokoro disclosure. As a consequence, the Applicants respectfully submit that Claims 29, 32, 40 and 44-45 are not obvious over Tadokoro. Withdrawal of the rejection is respectfully requested.

Claims 47-48 stand rejected under 35 USC §103 over the combination of Katayama with Tadokoro. The Applicants respectfully submit that Katayama fails to cure the deficiencies set forth above with respect to Tadokoro. Withdrawal of the rejection is also respectfully requested.

In light of the foregoing, the Applicants respectfully submit that the entire application is now in condition for allowance, which is respectfully requested.

Respectfully submitted,

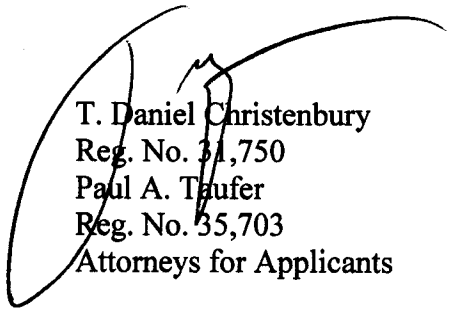

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表 1

	実施例1	実施例2	実施例3	比較例1	比較例2	比較例3	比較例4
原糸組成 (L/D=)	0.5dN66 (960) ユニメルト	0.5dN66 1.0dN66 (940) ユニメルト	0.5dN66 (960) ユニメルト	0.5dN66 (960) ユニメルト	0.5dN66 (960) ユニメルト	0.5dN66 (4870) ユニメルト	0.5dN66 合成パルプ ユニメルト
シート形成	湿式法	湿式法	湿式法	湿式法	湿式法	乾式法	湿式法
目付 (g/m^2)	72	72	72	74	73	73	72
厚み (mm)	0.18	0.18	0.18	0.18	0.18	0.18	0.18
地合指数	74	77	70	70	72	116	105
引張強度 (kg/cm)	3.3	3.5	3.1	2.0	2.4	3.5	3.2
ガス通過性 ($cc/cm^2/sec$)	20	28	21	18	19	21	17
液体保持率 (%)	330	345	333	310	315	335	270
液体抱液率 (%)	90	87	89	62	63	79	68
液体吸液速度 (mm)	88	78	85	62	79	86	48
圧縮応力 (kg/cm^2)	3.94	4.12	3.86	2.01	2.21	3.33	2.00
電気抵抗 (Ω)	0.65	0.70	0.69	2.10	1.56	1.10	3.5
交絡点間距離 (μm)	120	140	200	>350	320	150	305

表1から明らかなように、比較例1～2の不織布に対して、実施例1～3の不織布は引張強度が高く電気抵抗が低く、且つ液体抱液率にも優れる。これは交絡点間距離が 120～ 200μmになるまで交絡処理されたことによる引張強度向上、交絡点の増加、セパレータ

表 2

	実施例 4	比較例 5	比較例 6	実施例 5	比較例 7
原糸組成 (L/D=)	2.0dN66 (1060) ユニメルト	2.0dN66 (1060) ユニメルト	2.0dN66 (3600) ユニメル	2.0dN66 /N612 (1060) ユニメルト	2.0dN66 /N612 (354) ユニメルト
シート形成	湿式法	湿式法	乾式法	湿式法	湿式法
目付 (g/m^2)	85	86	84	72	72
厚み (mm)	0.20	0.21	0.20	0.18	0.18
地合指数	90	85	121	95	154
引張強度 (kg/cm)	3.9	2.3	4.2	3.7	1.7
ガス通過性 ($cc/cm^2/sec$)	63	60	62	21	15
液体保持率 (%)	365	350	360	305	300
液体抱液率 (%)	80	62	72	91	70
液体吸液速度 (mm)	111	87	115	105	74
圧縮応力 (kg/cm^2)	4.21	2.11	4.24	2.85	1.76
電気抵抗 (Ω)	0.73	2.25	1.45	0.85	3.25
交絡点間距離 (μm)	240	>400	300	135	308

〔実施例 6〕

繊維長 L = 6 mmである0.25デニール（単糸直径 D = 5.4 μm ; L／D = 1100）のナイロン 6 短繊維を80%、L = 10mmである 2 デニール（単糸直径 D = 14.1 μm ; L／D = 709)の熱融着繊維ユニメルト

表 3

	実施例 6	実施例 7	実施例 8	比較例 8	比較例 9
原糸組成 (L/D＝)	0.25dN66 (1100) ユニメルト	0.25dN66 0.5dN66 ユニメルト	0.05dN66 (1300) ユニメルト	2 μmN6	2 μmN6 0.5dN66 ユニメルト
シート形成法	湿式法	湿式法	湿式法	メルトブローン	同左積層
目付 (g/m^2)	65	65	65	65	66
厚み (mm)	0.15	0.15	0.15	0.15	0.15
⇒ 引張強度 (kg/cm)	3.1	3.4	3.2	0.9	1.8
ガス通過性 ($cc/cm^2/sec$)	11	12	10	6	8
液体保持率 (%)	300	302	310	310	301
液体抱液率 (%)	95	95	96	92	92
液体吸液速度 (mm)	120	110	120	100	100
圧縮応力 (kg/cm^2)	3.4	3.45	3.50	1.43	2.10
電気抵抗 (Ω)	0.65	0.60	0.70	1.12	1.20
交絡点間距離 (μm)	90	95	45	160	160
シート地合指数	55	56	49	43	103

シート地合参考データ：52(PPC用紙)

〔実施例 9〕

実施例 1 で得られた交絡シートを 180℃に設定したピンテンター乾燥機で乾燥すると同時に交絡シート間のユニメルトUL-61 の鞘部

（融点 140℃）を溶融せしめた。次いで、ノニオン系界面活性剤エマルゲン120(花王（株）製）のそれぞれ0.05%、 0.1%、0.25%、0.5%、１%、２%濃度の水溶液及び活性剤を含まない水のみに浸漬した後（それぞれのサンプルNoを１～７とする）、付着率が不織布の 200%に成るように絞り、温度 160℃に設定したピンテンター乾燥機で乾燥した。更に、 100℃に加熱した一対の金属ロールに導き、線圧30kg／cm^2 で実施例１と同じようにカレンダー加工を施して目付73ｇ／m^2 、厚さ0.18mmの電池のセパレーター用不織布を得た。得られた不織布の電池セパレーターとしての物性、性能を表４に示した。ノニオン系活性剤を全く付着していないものは、親水性が乏しく、活性剤付着量が多くなるにつれて、親水性が高くなる一方抱液率が低下する傾向が認められる。

表４　実施例９

	No. 7	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
目付(g/m^2)	72	72	72	72	72	72	72
厚み　(mm)	0.18	0.18	0.18	0.18	0.18	0.18	0.18
活性剤付着量（重量%）	0	0.1	0.2	0.5	1.0	2.0	4.0
引張強度 (kg/cm)	3.8	3.7	3.6	3.6	3.5	3.1	2.3
保液率（%）	浸漬せず	340	336	335	332	336	333
吸液速度 (mm)	5	120	123	130	138	148	178
抱液率（%）	浸漬せず	92	92	90	87	78	69

〔実施例10〕

実施例１で得られた交絡シートを 180℃に設定したピンテンター乾燥機で乾燥すると同時に交絡シート間のユニメルトUL-61 の鞘部

ーターを装着したものは安全弁リーク率が更に改善された。このことは、正極から発生した酸素ガスが電池の不織布セパレーターを通過し負極での消費反応が容易に進行した結果と考えられる。

表 6

	実施例1	実施例11	実施例12	実施例13	実施例14	実施例2	比較例1
目付 (g/m^2)	72	72	72	72	72	72	74
厚み (mm)	0.18	0.18	0.18	0.18	0.18	0.18	0.18
起毛応力 (kg/cm^2)	0.6	2.5	3.5	1.8	1.3	0.7	0.4
引張強度 (kg/cm)	3.3	3.1	3.0	3.2	3.2	3.5	2.0
抱液率 (%)	90	97	98	95	92	87	62
内部抵抗の上昇 (Ω)	0.16	0.10	0.10	0.12	0.13	0.17	0.46
過充電特性 (%)	2	0	0	0	1	0	33

産業上の利用可能性

本発明によれば、ガス通過性、液体保持性、液体吸液速度の優れた電池のセパレーター用不織布を得ることができる。しかも本発明の電池のセパレーター用不織布は、高い目付均一性と引張強度及び低い電気抵抗を有しており、従来にない優れた電池セパレーターを提供することができる。

本発明の電池のセパレーター不織布は、機械強度が十分な為電池装着時の破断、幅入れが無い上に、目付が均一で緻密な交絡構造なため、活物質の移行による耐ショート性に優れ、更にガス通気性、保液率、吸液速度性能が良好で、且つ電解液抱液能力、及びガス消費反応性に特に優れることから、密閉型2次電池に好適に採用する